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10/682,072	10/10/2003	Toshinobu Hamazaki	046601-5121	9494

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EXAMINER	
MRUK, GEOFFREY S	
ART UNIT	PAPER NUMBER
2853	

DATE MAILED: 01/23/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/682,072	HAMAZAKI ET AL.	
	Examiner	Art Unit	
	Geoffrey Mruk	2853	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12 October 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-11* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-11* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *12 October 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

Claim 11 is objected to because of the following informalities: line 3 states "a plurality for ejecting ink." For examination purposes, the examiner will examine line 3 as "a plurality of nozzles for ejecting ink."

Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

1. Claims 1, 2, 5, and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Weber (US 6,113,221) in view of Mitani (US 6,161,924).

With respect to claim 1, Weber discloses an ink-jet recording head (Fig. 1, element 12) comprising:

- a plurality of nozzles (Fig. 1, element 16) for ejecting an ink (Column 5, lines 9-11);
- a plurality of individual flow channels (Fig. 3a, element 22) filled with the ink and connected to the plurality of nozzles (Column 3a, element 16);

- a substrate (Fig. 3a, element 18) constituting a part of an inner wall of the plurality of individual flow channels;
- a thin film resistive element (Fig. 3a, element 28; Column 5, lines 34-44) which is provided on the substrate to be disposed in the vicinity of the plurality of nozzles in the plurality of individual flow channels and has a self-oxide film (Column 5, line 39, i.e. passivation layer) at least on a surface in contact with the ink (Column 4, lines 1-56); and
- a driving unit (Column 5, lines 45-52, i.e. microprocessor) that generates heat energy for ejecting the ink from the plurality of nozzles with the thin film resistive element by applying electricity thin film resistive element,
- the ink filled in the plurality of individual flow channels in the vicinity of the plurality of nozzles being ejected as ink droplets from the plurality of nozzles through expansion of bubbles (Fig. 3a, element 30) formed in the ink with heat energy from the thin film resistive element, and
- the bubbles formed in the plurality of individual flow channels being connected to atmospheric air through the plurality of nozzles (Fig. 3c, element 30; Column 4, lines 39-56)
- wherein the bubbles (Fig. 3c, element 30) are connected to the atmospheric air at substantially the same time as the ejection of the droplets (Fig. 3c, element 32; i.e. vapor bubble vents to atmosphere).

With respect to claim 2, Weber discloses upon ejecting the ink in the plurality of individual flow channels (Fig. 3a, element 22) as ink droplets from the plurality of

nozzles (Fig. 3a, element 16), the driving unit electrifies the thin film resistive element (Fig. 3a, element 28) with a series of driving signals comprising one or plural driving pulses (Column 5, lines 45-51).

With respect to claim 5, Weber discloses an electrode (Fig. 5, element 54) for electrifying the thin film resistive element (Fig. 5, element 28) is provided on the substrate (Fig. 3a, element 18), and the electrode is covered with the thin film resistive element (Column 5, lines 45-52).

With respect to claim 6, Weber discloses wherein a plane shape of an ink contact surface of the thin film resistive element (Fig. 5, element 28) is a substantially square shape.

However, Weber fails to disclose a Ta-Si-O ternary thin film resistive element.

Mitani discloses an ink jet recording head where the thin film resistor (element 3) is Ta-Si-O (Column 6, lines 49-49).

At the time of the invention, it would have been obvious to one of ordinary skill in the art to use the Ta-Si-O thin film resistor disclosed by Mitani for the heating element (Fig. 3a, element 28) disclosed by Weber. The motivation for doing so would have been "the life of each Ta--Si--O ternary alloy thin-film heater 3 will not be shortened by galvanization. Because the oxidized portion 4 is extremely thin, heat is transferred to the ink 8 equally as well as with the case where the heater 3 is not provided with the oxidized portion 4" (Column 6, lines 55-60).

2. Claims 3 and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Weber (US 6,113,221) as applied to claims 1 and 2 above, and further in view of Bohorquez et al. (US 5,736,995).

With respect to claims 3 and 4, Weber discloses an ink-jet recording head wherein the driving unit electrifies the thin film resistive element (Fig. 3a, element 28) with a series of driving signals (Column 5, lines 45-51).

However, Mitani fails to disclose the driving signals comprising:

- a pre-pulse and a main pulse, in which the pre-pulse is for preliminary heating the ink with the thin film resistive element with heat energy of such an extent that no bubble is formed, and the main pulse is for heating the ink with the thin film resistive element to form a bubble in the ink thus preliminary heated, and a number of the pre-pulse is changed depending on a temperature of the substrate;
- time widths of the pre-pulses with which the thin film resistive element is electrified are equalized, and electrification intervals of the pre-pulse and the main pulse constituting the series of driving signals are equalized when the ink in the individual flow channels is ejected by the driving unit as an ink droplet from the nozzles.

Bohorquez discloses:

- a pre-pulse (Fig. 4A, i.e. heating required) and a main pulse (Fig.4B, i.e. print data), in which the pre-pulse is for preliminary heating the ink with the resistive element (Fig. 1, element 38) with heat energy of such an extent that no bubble is

formed (Column 5, lines 40-53), and the main pulse is for heating the ink with the resistive element to form a bubble in the ink thus preliminary heated, and a number of the pre-pulse is changed depending on a temperature of the substrate (Column 6, lines 9-36);

- time widths of the pre-pulses with which the resistive element (Fig. 1, element 38) is electrified are equalized (Fig. 4A; Column 6, lines 9-26) and electrification intervals of the pre-pulse (Fig. 4A, i.e. heating required) and the main pulse (Fig.4B, i.e. print data) constituting the series of driving signals are equalized when the ink in the individual flow channels is ejected by the driving unit as an ink droplet from the nozzles (Column 5, lines 54-62).

At the time of the invention, it would have been obvious to one of ordinary skill in the art to use the temperature control of thermal inkjet print heads disclosed by Bohorquez in the ink jet recording head of Weber. The motivation for doing so would have been to allow "all elements of the printhead to be used for both printing and warming with minimal additional electronics" (Column 6, lines 14-17).

3. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Weber (US 6,113,221) in view of Mitani et al. (US 6,161,924) as applied to claims 1 and 6 above, and further in view of Deshpande et al. (US 6,079,819).

With respect to claim 7, Weber discloses the ink-jet recording head (Fig. 1, element 12).

However, Weber fails to disclose a diameter of the nozzle, a nozzle length from an inlet to an outlet of the nozzle, and a distance from the ink contact surface of the thin

film resistive element to the inlet of the nozzle are substantially equal to about 1/2 of a length of one edge of the ink contact surface.

Deshpande discloses a diameter of the nozzle (Fig. 4, element 27), a nozzle length from an inlet to an outlet of the nozzle (Fig. 4, element A), and a distance from the ink contact surface of the resistive element to the inlet of the nozzle (Fig. 4, element F) are substantially equal to about 1/2 of a length of one edge of the ink contact surface (Fig. 4, element H; Column 5, lines 55-67; Column 6, lines 1-15).

At the time of the invention, it would have been obvious to one of ordinary skill in the art to use the ink jet printhead having a low cross talk ink channel structure disclosed by Deshpande in the ink jet recording head of Weber. The motivation for doing so would have been to "to provide an ink jet printhead having an ink channel structure which is formed directly on the heater plate, wherein said channel structure minimizes fluidic crosstalk between neighboring channels" (Column 2, lines 24-27).

4. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Weber (US 6,113,221) in view of Deshpande et al. (US 6,079,819) as applied to claim 7 above, and further in view of Inui et al. (US 6,203142 B1).

Weber and Deshpande references disclose all the limitations of the ink-jet recording head except the ink contact surface has an area within a range of from 500 to 1,800 μm.

Inui discloses the ink contact surface has an area within a range of from 500 to 1,800 μm (Column 5, lines 13-31; Table 1, element S1).

At the time of the invention, it would have been obvious to one of ordinary skill in the art to use the teachings of the tertiary reference of Inui in the ink jet recording head of Weber. The motivation for doing so would have been to provide an ink jet recording head where "If the above conditions are satisfied, quick and efficient bubble expansion and communication ejection, are accomplished, and therefore, the ejected droplet volumes and the ejection speeds are made more uniform. Therefore, the image quality is improved" (Column 3, lines 39-43).

5. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Weber (US 6,113,221) view of Deshpande et al. (US 6,079,819) as applied to claim 7 above, and further in view of Hirasawa et al. (US 5,988,798).

Weber and Deshpande references disclose all the limitations of the ink-jet recording head except the ink droplet is ejected from the nozzle has a volume of from 2 to 16 pL.

Hirasawa discloses the ink droplet is ejected from the nozzle has a volume of from 2 to 16 pL (Table 2, amount of ejected ink in Design 1 and 2).

At the time of the invention, it would have been obvious to one of ordinary skill in the art to use the teachings of the tertiary reference of Hirasawa in the ink jet recording head of Weber. The motivation for doing so would have been to "give a good performance of the ejection head" (Column 14, lines 44-45).

6. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Weber (US 6,113,221) in view of Deshpande et al. (US 6,079,819) as applied to claim 7 above,

in view of Inui et al. (US 6,203,142 B1) as applied to claim 8 above, and further in view of Prasad et al. (US 6,139,131).

Weber, Deshpande, and Inui references disclose all the limitations of the ink-jet recording head except:

- the plurality of nozzles are arranged in an arranging direction thereof perpendicular to a head moving direction, which is a direction along which the ink-jet recording head is moved upon recording on a recording material and
- a pitch of the plurality of nozzles along the arranging direction is a length corresponding to a resolution of from 800 to 1,600 dpi.

Prasad discloses:

- the plurality of nozzles (Fig. 7a, elements 703, 705, 707) are arranged in an arranging direction thereof perpendicular to a head moving direction, which is a direction along which the ink-jet recording head (Fig. 2, element 109; Column 5, line 60, i.e. print heads are included in the carriage) is moved upon recording on a recording materials (Fig.2, element 105); and
- a pitch of the plurality of nozzles along the arranging direction is a length corresponding to a resolution of from 800 to 1,600 dpi (Column 9, lines 54-59).

At the time of the invention, it would have been obvious to one of ordinary skill in the art to use the teachings of the quaternary reference of Hirasawa in the ink jet recording head of Weber. The motivation for doing so would have been to enable "compact printheads with high-density drop generators and high printing throughput but without excessive heat generation within the printhead" (Column 3, lines 60-64).

7. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Weber (US 6,113,221) in view of Mitani et al. (US 6,161,924) and further in view of Prasad et al. (US 6,139,131).

With respect to claim 11, the primary reference of Weber discloses an ink-jet recording apparatus (Column 1, lines 13-16) comprising:

- an ink-jet recording head (Fig. 1, element 12) comprising:
- a plurality of nozzles (Fig. 1, element 16) for ejecting an ink (Column 5, lines 9-11);
- a plurality of individual flow channels (Fig. 3a, element 22) filled with the ink and connected to the plurality of nozzles (Column 3a, element 16);
- a substrate (Fig. 3a, element 18) constituting a part of an inner wall of the plurality of individual flow channels;
- a thin film resistive element (Fig. 3a, element 28; Column 5, lines 34-44) which is provided on the substrate to be disposed in the vicinity of the plurality of nozzles in the plurality of individual flow channels and has a self-oxide film (Column 5, line 39, i.e. passivation layer) at least on a surface in contact with the ink (Column 4, lines 1-56); and
- a driving unit (Column 5, lines 45-52, i.e. microprocessor) that generates heat energy for ejecting the ink from the plurality of nozzles with the thin film resistive element by applying electricity thin film resistive element,
- wherein the ink filled in the plurality of individual flow channels in the vicinity of the plurality of nozzles is ejected as ink droplets (Fig. 3c, element 32) from the

plurality of nozzles through expansion of bubbles (Fig. 3c, element 30) formed in the ink with heat energy from the thin film resistive element, and

- the bubbles formed in the plurality of individual flow channels are connected to atmospheric air through the plurality of nozzles Column 4, lines 39-56),
- wherein the bubbles (Fig. 3c, element 30) are connected to the atmospheric air at substantially the same time as the ejection of the ink droplets (Fig. 3c, element 32; i.e. vapor bubble vents to atmosphere).

However, the primary reference of Weber fails to disclose

- a Ta-Si-O ternary thin film resistive element, and
- the plurality of nozzles are arranged in an arranging direction thereof perpendicular to a head moving direction, which is a direction along which the ink-jet recording head is moved upon recording on a recording materials and
- a pitch of the plurality of nozzles along the arranging direction is a length corresponding to a resolution of from 800 to 1,600 dpi;
- the ink-jet recording apparatus also comprising: a head driving unit that drives the ink-jet recording head along a head moving direction; and
- a conveying unit that conveys a recording material along the arranging direction of the plurality of nozzles relative to the ink-jet recording head.

The secondary reference of Mitani discloses an ink jet recording head where the thin film resistor (element 3) is Ta-Si-O (Column 6, lines 49-49).

At the time of the invention, it would have been obvious to one of ordinary skill in the art to use the Ta-Si-O thin film resistor disclosed by Mitani for the heating element (Fig.

3a, element 28) disclosed by Weber. The motivation for doing so would have been "the life of each Ta--Si--O ternary alloy thin-film heater 3 will not be shortened by galvanization. Because the oxidized portion 4 is extremely thin, heat is transferred to the ink 8 equally as well as with the case where the heater 3 is not provided with the oxidized portion 4" (Column 6, lines 55-60).

The tertiary reference of Prasad discloses:

- the plurality of nozzles (Fig. 7a, elements 703, 705, 707) are arranged in an arranging direction thereof perpendicular to a head moving direction, which is a direction along which the ink-jet recording head (Fig. 2, element 109; Column 5, line 60, i.e. print heads are included in the carriage) is moved upon recording on a recording materials (Fig.2, element 105); and
- a pitch of the plurality of nozzles along the arranging direction is a length corresponding to a resolution of from 800 to 1,600 dpi (Column 9, lines 54-59);
- the ink-jet recording apparatus also comprising:
- a head-driving unit (Fig. 2, element 211) that drives the ink-jet recording head along a head moving direction; and
- a conveying unit (Fig. 2, element 209) that conveys a recording material along the arranging direction of the plurality of nozzles relative to the ink-jet recording head (Figs. 1 and 2).

At the time of the invention, it would have been obvious to one of ordinary skill in the art to use the teachings of the high drop generator density printhead disclosed by the tertiary reference of Prasad in the ink jet recording head of Weber. The motivation for

doing so would have been to enable "compact printheads with high-density drop generators and high printing throughput but without excessive heat generation within the printhead" (Column 3, lines 60-64).

Response to Arguments

Applicant's arguments with respect to claims 1 and 11 have been considered but are moot in view of the new ground(s) of rejection. The applicant's argument "that Mitani et al. and Prasad et al., whether taken singly or combined, do not disclose a combination having bubbles formed in the plurality of individual flow channels being corrected to atmospheric air through the plurality of nozzles" is moot in view of the new grounds of rejection. The examiner makes of record that the drawing objections dated 27 July 2005 are withdrawn in view of applicant's remarks.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the

shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Geoffrey Mruk whose telephone number is 571 272-2810. The examiner can normally be reached on 7am - 330pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen Meier can be reached on 571 272-2149. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

GSM
1/13/2006

GM

1/19/06
MANISH S. SHAH
PRIMARY EXAMINER